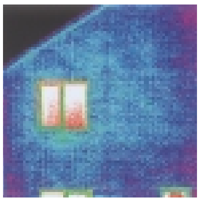
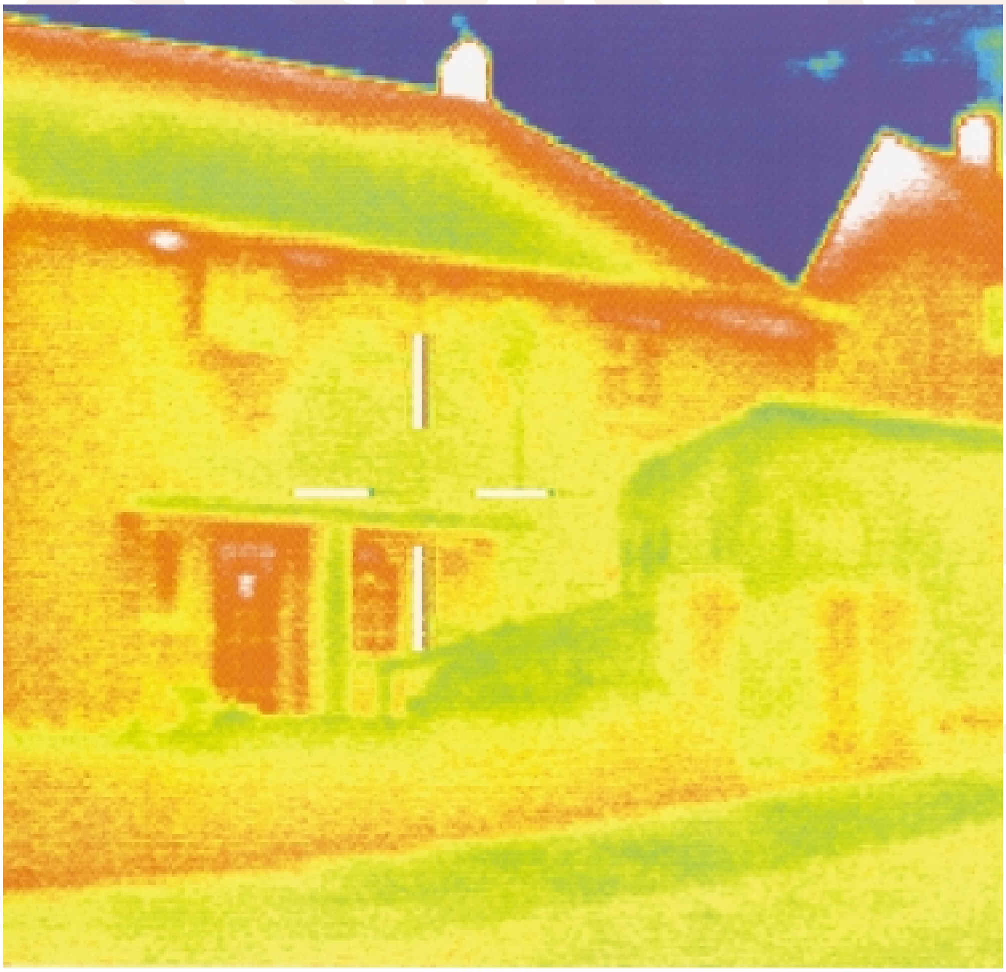


Injected Mineral Fibre Full Fill Cavity Wall Insulation, Workmanship, Voids and Heat Loss

A White Paper

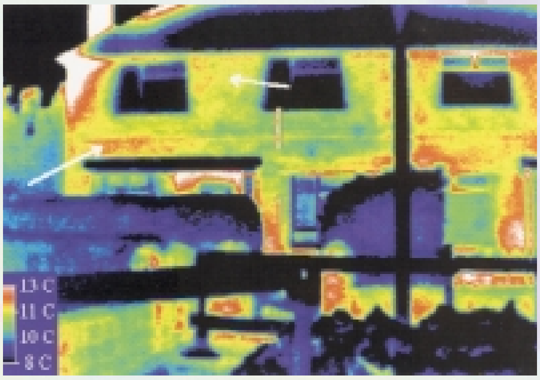


Contents

1 *Executive Summary*

1.1 Kingspan Insulation Ltd approached two local authorities for permission to carry out exploratory thermographic imaging of publicly owned properties insulated with injected mineral fibre full fill cavity wall insulation.

1.2 The two local authorities selected, at their discretion and with a totally free hand, 469 publicly owned properties of which Kingspan Insulation thermographically surveyed 84.



This image shows the front elevation of a notionally insulated property to the left. The adjoining unit to the right is uninsulated.

1.3 Thermographic investigations were followed up by endoscopic investigations of 20 of the 84 properties which involves drilling holes in the properties' walls through which an endoscope is passed to view the walls' cavities.

1.4 Of the 84 properties surveyed, 34 showed thermographic patterns which are often associated with missing or low density insulation. The presence of voids and low density insulation was confirmed by the endoscopic survey.

1.5 Amalgamating the heat losses caused by these defects gives the resulting summation of 1200 kWh of additional heat loss per year which equates to 344 kg CO_2 equivalent emissions per year and a financial loss of £27 per year for a house with a wall area of 42 m^2.

1.6 Assuming that the properties surveyed are representative of the wider housing stock insulated in this way (3.4 million properties), the use of injected mineral fibre full fill cavity wall insulation could be regarded as wasting the UK 1651 GWh (million kWh) of heat per year.

1.7 That is equivalent to the output of 0.550 power stations of an average output of 3000 GWh.

1.8 Furthermore, this could be regarded as causing 473 million kg (473,000 T) of CO_2 equivalent emission to be pumped into the atmosphere per year with its consequent effects on global warming.

1.9 That is equivalent to 0.57% of the UK's commitment to CO_2 equivalent emissions reduction under the 1997 Kyoto Protocol of 83 million T of CO_2 equivalent emissions (12.5% reduction from 1990 emission levels).

1.10 Finally, this could be regarded as costing occupiers of properties so insulated £37.2 million per year in wasted fuel bills.

1.11 Re-filling voids or gaps in injected mineral fibre full fill cavity wall insulation, where it can be done, is expensive, requiring the employment of thermographic equipment to control the work.

1.12 Little can be done to remedy any problems which may arise in low density injected mineral fibre full fill cavity wall insulation.

2 *Introduction*

2.1 This ‘White Paper’ from Kingspan Insulation is one of a series, highlighting the serious implications that inadequate site workmanship and supervision can have on the performance of insulation materials.

2.2 Most insulation materials perform as claimed under controlled installation conditions and when tested in a laboratory environment. However, when taken into the world of real site practices, not all may perform as predicted.

2.3 This ‘White Paper’ focuses on the implications that inadequate site workmanship and supervision can have on the performance of injected mineral fibre full fill cavity wall insulation. In particular it investigates the effects of voids and low density insulation and the consequences for exacerbated heat loss, and the environmental and financial implications of this.

2.4 For the purposes of this White Paper the definition of mineral fibre is taken from BS 3533 : 1981 (Glossary of thermal insulation terms) and includes both glass fibre and rock fibre.

3 *Workmanship*

3.1 The condition of the wall cavity prior to installation is critical to the success of injected mineral fibre full fill cavity wall insulation. Indeed system manufacturers state that the walls being injected with mineral fibre full fill cavity wall insulation must be 'properly constructed' or constructed in accordance with the relevant sections of BS and/or IS Codes of Practice. Dirty ties or mortar snots on the inner faces of either leaf do not constitute a wall so constructed. If rigorous quality control during wall construction was not implemented then dirty cavities may result. There is very little scope to clean dirty cavities once the wall is complete. Dirty ties or mortar snots on the inner faces of either leaf can create voids in the insulation under normal drilling patterns.

3.2 The cavity width is another influencing factor which has to be considered with injected mineral fibre full fill cavity wall insulation. Since installation equipment is sensitive to back pressure, too narrow a cavity can be difficult to properly fill. This is due to the injection equipment shutting off prematurely if the installer is not careful in controlling the depth of the nozzle. The result can be reduced mineral fibre density. BS 8208 : Part 1 : 1985 (Assessment of suitability of external cavity walls for filling with thermal insulants.) requires that the cavity to be filled is at least 40 mm wide.

3.3 Cavities may vary in width which also makes it difficult for any installer to assess whether cavities have been fully filled.

3.4 It is required by the BBA Certificates, for injected mineral fibre full fill cavity wall insulation systems, that the condition of the cavity should be ascertained in pre-installation surveys to properties in accordance with BS 8208 : Part 1 : 1985. The suitability of the property for injected mineral fibre full fill cavity wall insulation, as judged by the cleanliness and width of its cavities, is determined by the results of this inspection.

3.5 A difficulty even with clean cavities is that when the drilling of the injection holes is being carried out, the rear of the bricks can spall into the cavity causing blockages lower down. These can also prevent the complete installation of the mineral fibre.

3.6 Injection holes are drilled in positions defined by system manufacturers and not by site operatives. This makes the accommodation of building details sub-optimal.

3.7 Areas below window sills and between penetrations such as windows and doors may be left uninsulated if a suitable hole drilling pattern is not adhered to.

3.8 Where penetrations through the wall occur such as soil pipes or cables, the risk of voids in the mineral fibre are increased significantly unless these are specifically addressed in the drilling pattern. BS 8208 : Part 1 : 1985 requires that their position is noted in pre installation checks such that their presence can be accommodated.

3 *Workmanship*

3.9 A normal process on site on large contracts is for one team to drill all of the injection holes prior to a subsequent team filling the cavities. This procedure means that the filling team can be restricted to installing the insulation where the holes have previously been bored. They cannot easily allow for any installation problems which they may experience.

3.10 Property owners are reliant upon 'Approved Installers' for the quality and supervision of pre-installation surveys and actual installation. It is claimed that these 'Approved Installers' are fully trained and approved by system manufacturers and the BBA. In reality, cavity wall insulation contractors can make use of short term unskilled labour provided with inadequate training and paid per unit insulated.

3.11 The result of the above issues in relation to site workmanship and supervision can be the creation of voids in the insulation together with possible areas of low density insulation.

4 *Case Studies – Background*

4.1 Kingspan Insulation Ltd approached two local authorities (A and B) for permission to carry out exploratory thermographic imaging of publicly owned properties insulated with injected mineral fibre full fill cavity wall insulation.

4.2 The two local authorities selected, at their discretion and with a totally free hand, two housing estates. One estate was in local authority A and the other was in local authority B.

4.3 Local authority A identified a list of 19 streets with a total of 456 publicly owned properties insulated with injected mineral fibre full fill cavity wall insulation. Kingspan chose one street to survey with 71 publicly owned properties from this list, purely for reasons of property density.

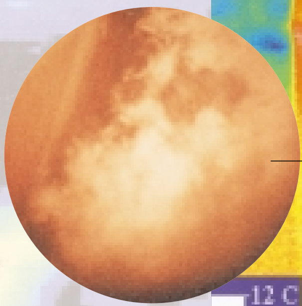
4.4 Local authority B identified a list of 13 properties in one street that had been insulated with injected mineral fibre full fill cavity wall insulation.

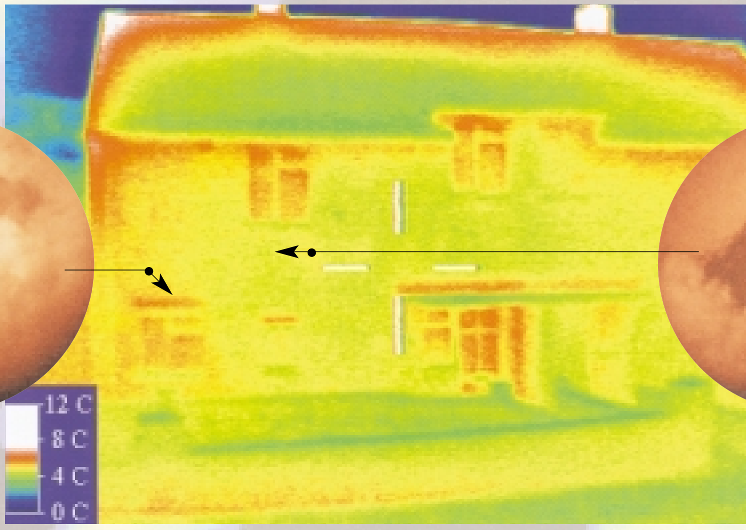
4.5 In the case of the local authority A survey, the thermographic investigations were followed up by endoscopic investigations of 20 of the 71 properties which involves drilling holes in the properties' walls through which an endoscope is passed to view the walls' cavities.

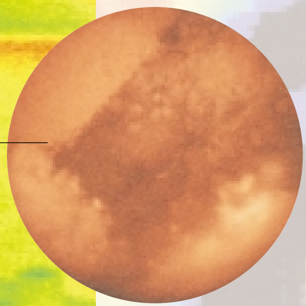
4.6 Local Authority B declined the opportunity to carry out endoscopic investigations.

5 *Case Study – Local Authority A*

Image 1





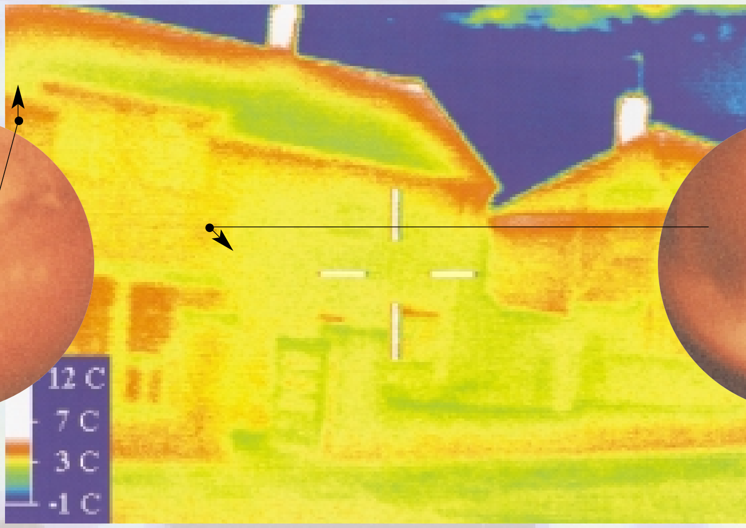


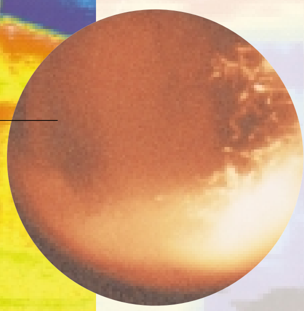
This image shows the outer surface of the inner leaf to the left hand side of the image. The mineral fibre is seen both in the centre and to the right of the image. This is approximately 300mm away from the viewing position and thus indicates a void. The darker area to the top of the image indicates that the mineral fibre is of low density at that location and it can be seen that the mineral fibre does not fully fill the cavity at this position.

This image shows the front elevation of property #4 and indicates some irregular heat loss patterns below the upper left hand window and between the lower left hand window and the eaves line. Thermal bridging at the lower window units appears as red rectangular patterns.

This image shows the inner surface of the outer leaf on the lower right hand side. The mineral fibre is seen to the lower left and to the upper right. A distinct void in the mineral fibre is noticed in the centre of the image as the darker area. This void extends approximately 0.5m to the left and right of the bore hole location.

Image 2





This image is of a view immediately below the eaves within the cavity. The inner surface of the outer leaf is to the bottom of the image and the mineral fibre to the top. It is obvious that a clear void exists across the cavity at this location.

This image shows the front elevation of properties #62 and #64 which comprise the left hand of the two semi detached blocks in the image. Properties #62 and #64 indicate areas of increased heat loss.

This image shows mineral fibre within the cavity to the lower right illuminated by the light source and a darker area to the upper left which indicates a void behind the mineral fibre immediately in front of the endoscope. This void is approximately 500mm in diameter.

Key:

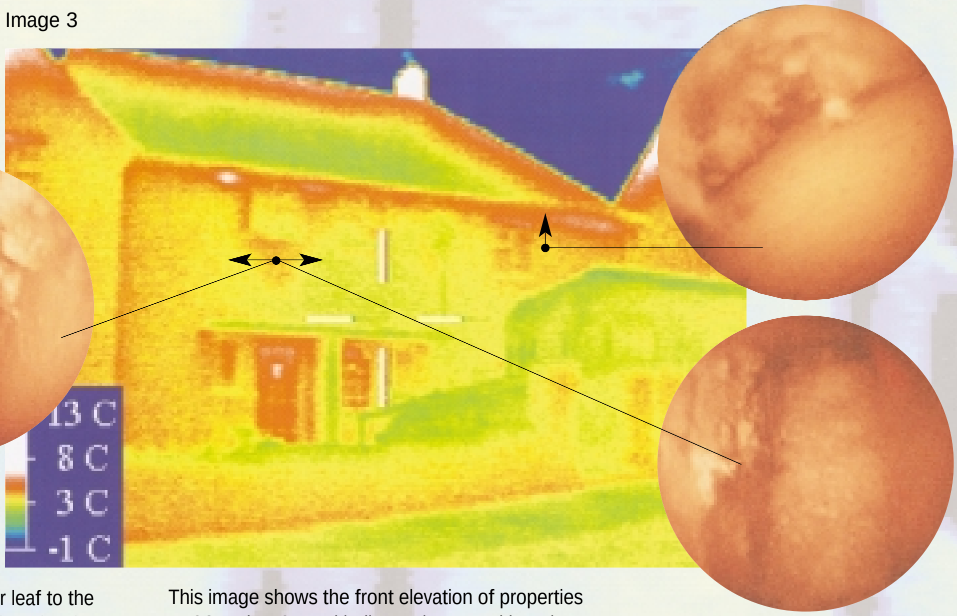
Drill hole

Direction of view

5 *Case Study – Local Authority A*

This image shows the inner surface of the outer leaf to the lower right and the mineral fibre to the upper left. A void exists and small gaps are present between the insulant and the outer leaf.

Image 3

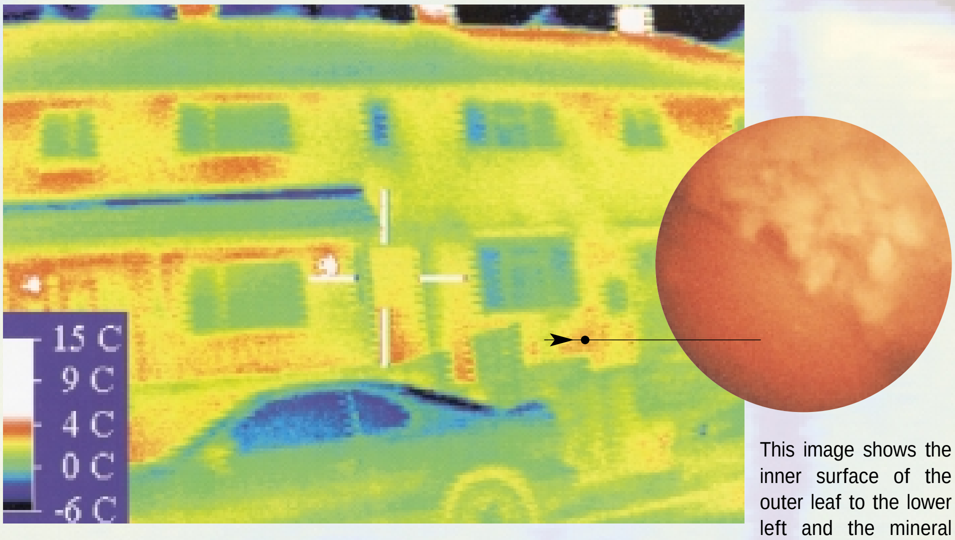


This image shows the inner surface of the outer leaf to the left of the image and the outer surface of the inner leaf to the right. A large void exists in the mineral fibre. The darker band running vertically in the centre is mineral fibre approximately 1 metre away.

This image shows the front elevation of properties #102 and #104 and indicates increased heat loss occurring below the upper window in the centre of the image in the form of a red triangular area.

This image shows the inner surface of the outer leaf to the right of the image. The mineral fibre is a band running vertically in the centre of the image. This mineral fibre is 500mm away. This is a large void.

Image 4



This image shows the front elevation of properties #43, #45 and #47. The property to the left is privately owned and uninsulated. The two properties to the right which are insulated display thermal patterns indicating insulation defects around windows and doors.

This image shows the inner surface of the outer leaf to the lower left and the mineral fibre to the upper right. A void exists at this location and gaps exist between the mineral fibre and the outer leaf.

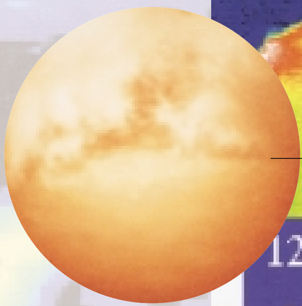
Key:

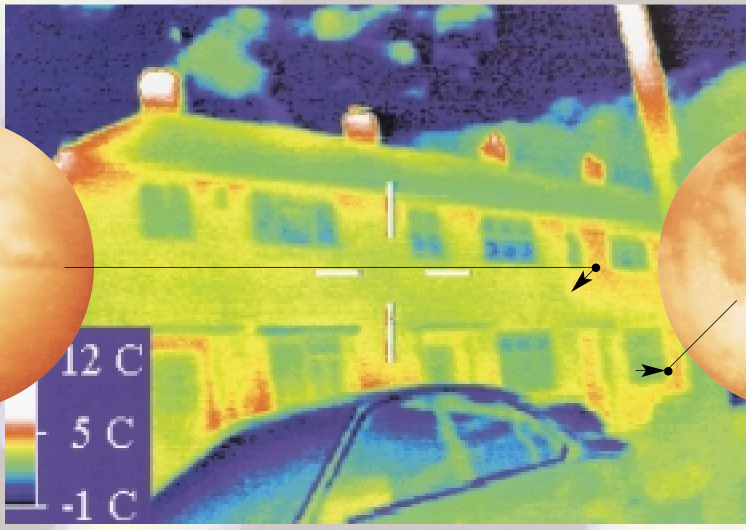
Drill hole

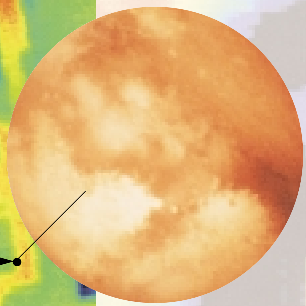
Direction of view

5 Case Study – Local Authority A

Image 5





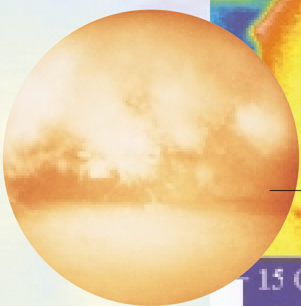


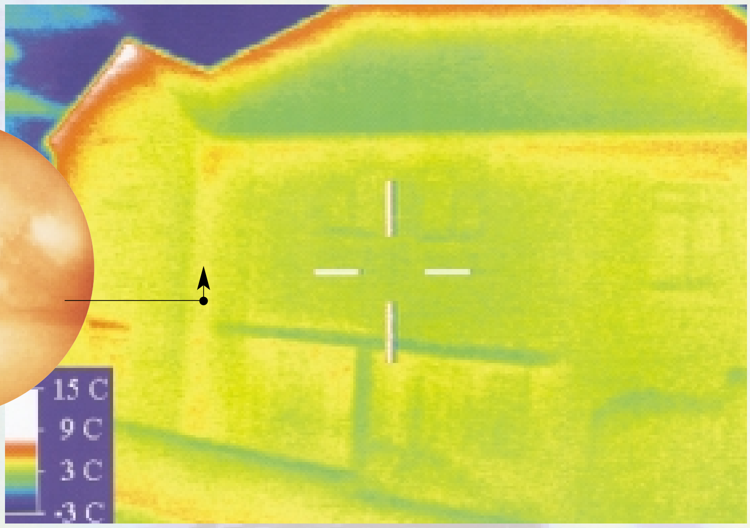
This image shows the outer surface of the inner leaf to the bottom and the mineral fibre to the top. The mineral fibre is 300-500mm away from the viewing position proving the existence of a void at this location. The darker area in the centre also indicates that the insulation is of low density beyond this position.

This image shows the front elevation of properties #21, #23, #25 and #27. The property endoscoped is the only property owned by local authority A and the only property insulated with injected mineral fibre full fill cavity wall insulation under the same contract as the others surveyed. The red patterns indicate higher levels of heat loss around windows.

This image shows the inner surface of the outer leaf to the upper right and the mineral fibre to the lower left. It is clear that small gaps exist within the mineral fibre and that a gap exists between the mineral fibre and the inner surface of the outer leaf. This gap varied from 10mm at the lower right to 40mm at the upper left of the image.

Image 6





This image shows a view looking upwards within the cavity of the short return wall. The inner surface of the outer leaf is seen to the bottom and the mineral fibre to the top. Across the centre the dark band is the underside of the first floor window cill. A distinct void exists at this location and the mineral fibre clearly varies in density.

This image shows the front elevation of properties #18 and #20 and shows some localised heat loss at the short return wall to the left. The vertical red band at ground floor level indicates possible missing insulation.

Key:

Drill hole

Direction of view

6 *Case Study – Local Authority B*

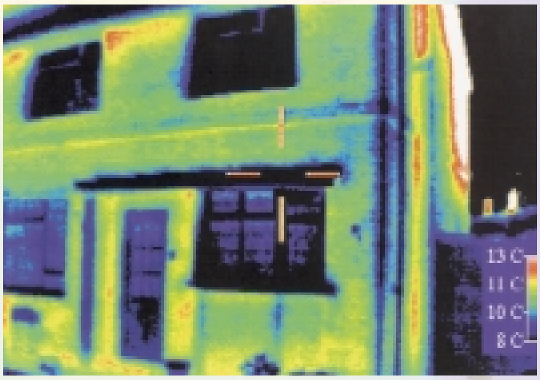


Image 7
This image shows the front elevation of property #4 and indicates some increased heat loss close to ground level at the bay window. This is likely to be due to missing or low density insulation. Thermal bridging is noticed around the door porch junctions with the wall.

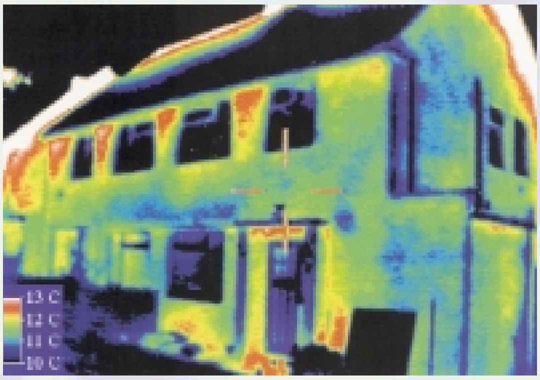


Image 8
This image shows the front and gable elevation of property #24. The irregular patterns across the entire wall indicate significant missing or low density insulation, particularly immediately below and adjacent to windows.

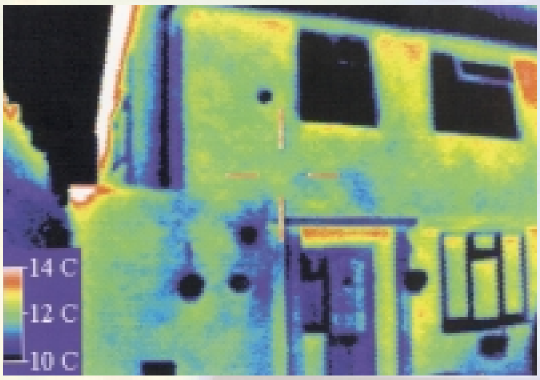


Image 9
This image shows the front elevation of property #30. The red and yellow patterns below the upper windows, at the party wall location, and between the entrance porch and living room window, indicate likely missing or low density insulation.

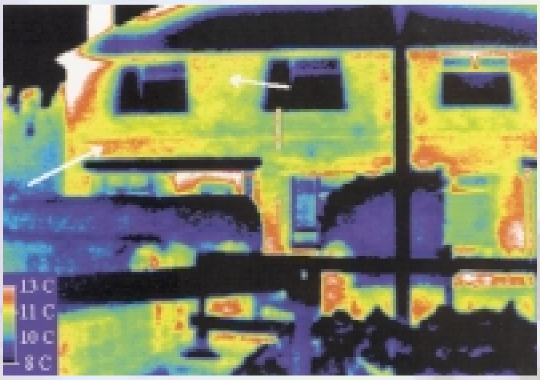


Image 10
This image shows the front elevation of property #35 to the left. The adjoining unit to the right is uninsulated. The large red patterns above the entrance doorway to property #35 and between its upper windows indicate likely missing or low density insulation.

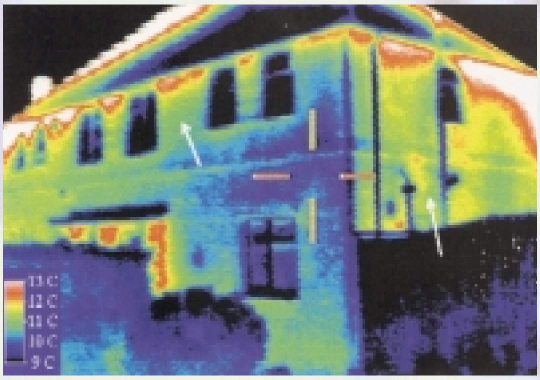


Image 11
This image shows the front and gable elevations of property #40 to the right. The light green areas on the front elevation indicate likely low density insulation. The gable elevation shows likely increased heat loss around pipe penetrations and below the upper window. This is likely due to missing insulation.

7 Case Studies – Summary of Results

7.1 Of the 71 properties surveyed for Local Authority A, 26 showed thermographic patterns which are often associated with missing or low density insulation. The presence of voids and low density insulation was confirmed by the endoscopic survey. The majority of insulation defects were found to be located below window positions and within the smaller wall panel sections between components such as windows and doors. In addition to these most common locations for defects, they were also recorded at penetrations through the wall and at points equidistant between injection holes. Thermal bridging identified at some window lintel positions indicates that injected mineral fibre full fill cavity wall insulation may not prevent such heat loss.

7.2 Of the 13 properties surveyed for Local Authority B, eight showed thermographic patterns which are often associated with missing or low density insulation. The majority of likely insulation defects were found to be located below window positions and within the smaller wall panel sections between components such as windows and doors. Thermal bridging identified at the junctions of the door porches to walls indicates that injected mineral fibre full fill cavity wall insulation may not prevent such heat loss.

7.3 Of the 71 properties in the thermographic survey in local authority A, 20 were selected for endoscope inspection. All of the 20 properties showed insulation defects to some degree.

7.4 Of the 20 properties in the endoscope survey, 14 were found to contain voids within the cavities. These voids typically accounted for 10-20% of the wall area. The size of those voids identified varied from location to location but in some instances would be approximately 1-1$^1/_2$m^2.

7.5 Low density insulation was noted in 7 of the 20 properties in the endoscope survey and appeared to extend over significant areas of walls. This type of defect is typically found equidistant between injection holes (caused when injection is prematurely cut off) and where obstructions exist such as mortar snots within the cavity. The low density of mineral fibre found within the cavities appeared to be below the acceptable ranges given for the product. The lack of density may significantly affect the thermal performance and could lead to increased heat loss through those defective areas. Generally, the total area which low density insulation extended over accounts for 10-15% of the wall area.

7.6 Half of the 20 properties in the endoscope survey were found to contain gaps between the mineral fibre (where it was present) and the inner face of the outer leaf of brick, even when the mineral fibre appeared to be of correct density. The width of the gap was typically 20 mm. At the majority of locations where this defect existed the gaps extended beyond viewing distance. The general area which these gaps extended over was seen to be 0.5-5.0m^2 and they typically account for 3-35% of the wall area (a total of 1.5-15m^2).

8 Consequences

8.1 Areas of wall exhibiting voids will have an approximate U-value of 1.39 W/m^{2}K while the fully insulated areas will provide a U-value of 0.44 W/m^{2}K (assuming a 70 mm cavity).

8.2 Assuming 15% of the wall area exhibited voids, and using the methodology given in the Kingspan document 'Lifetime Energy, CO_2 and Financial Balances for Insulation Materials - A White Paper', these voids would cause an additional 573 kWh of heat to be lost from a property of 42 m^2 wall area in one year. This is a 32% increase in heat loss for the wall as a whole. This additional heat loss would be responsible for 164 kg of CO_2 equivalent emissions per year and a financial loss of £13 per year.

8.3 Assuming low density mineral fibre has the same insulating effect as a void, the area of wall filled with low density mineral fibre will have an average U-value of 1.39 W/m^{2}K while the areas of wall filled with correct density mineral fibre will provide a U-value of 0.44 W/m^{2}K (assuming a 70 mm cavity).

8.4 Assuming 15% of the wall area exhibited low density mineral fibre and using the methodology given in the Kingspan document 'Lifetime Energy, CO_2 and Financial Balances for Insulation Materials - A White Paper', these areas of low density mineral fibre would also cause an additional 573 kWh of heat to be lost from a property of 42 m^2 wall area in one year. This is a 32% increase in heat loss for the wall as a whole. This additional heat loss would be responsible for 164 kg of CO_2 equivalent and emissions per year and a financial loss of £13 per year.

8.5 Areas of wall exhibiting typical 20 mm gaps between the mineral fibre and the inner face of the outer leaf will have an approximate U-value of 0.53 W/m^{2}K while fully insulated areas will provide a U-value of 0.44 W/m^{2}K (assuming a typical 70 mm cavity).

8.6 Assuming 15% of the wall area exhibited such gaps and using the methodology given in the Kingspan document 'Lifetime Energy, CO_2 and Financial Balances for Insulation Materials - A White Paper', these areas of low density mineral fibre would cause an additional 54 kWh of heat to be lost from a property of 42 m^2 wall area in one year. This is a 3% increase in heat loss for the wall as a whole. This additional heat loss would be responsible for 16 kg of CO_2 equivalent and emissions per year and a financial loss of £1 per year.

8.7 Amalgamating the losses caused by all three types of defect gives the resulting summation of 1200 kWh of additional heat loss per year which equates to 344 kg CO_2 equivalent emissions per year and a financial loss of £27 per year.

8.8 According to BRECSU (Cavity wall insulation: unlocking the potential in existing dwellings. General Information Leaflet 23. 1993) and confirmed verbally by the National Cavity Installers Association (NCIA), 4 million properties in the UK have been insulated with injected full fill cavity wall insulation. 85% (3.4 million) of these are insulated with mineral fibre (Pers. Comm. BRE). This includes properties insulated with injected mineral fibre full fill cavity wall insulation when newly built.

8 *Consequences*

8.9 40.5% (34 of the 84) of the properties in the two surveys showed thermographic patterns which can be associated with missing or low density insulation. Assuming that the properties surveyed in local authority A and B are representative of the wider housing stock insulated in this way, on a national level 40.5% of the 3.4 million properties in the UK that have been insulated with injected full fill cavity wall insulation equates to 1.376 million properties with possible missing or low density insulation.

8.10 Assuming that the properties surveyed in local authority A and B are representative of the wider housing stock insulated in this way, the use of injected mineral fibre full fill cavity wall insulation could be regarded as wasting the UK 1651 GWh (million kWh) of heat per year.

8.11 That is equivalent to the output of 0.550 power stations of an average output of 3000 GWh.

8.12 Furthermore, this could be regarded as causing 473 million kg (473,000 T) of CO_2 equivalent emissions to be pumped into the atmosphere per year with its consequent effects on global warming.

8.13 That is equivalent to 0.57 % of the UK's commitment to CO_2 equivalent emissions reduction under the 1997 Kyoto Protocol of 83 million T of CO_2 equivalent emissions (12.5% reduction from 1990 emission levels).

8.14 Finally, this could be regarded as costing occupiers of properties so insulated £37.2 million per year in wasted fuel bills.

9 *Remedies*

9.1 Re-filling voids or gaps in injected mineral fibre full fill cavity wall insulation, where it can be done, is expensive, requiring the employment of thermographic equipment to control the work. In addition, refilling voids can lead to a local increase in fibre density which can create a 'stratification of the fibre which may itself promote rain penetration' (Newman, A.J. Rain Penetration Through Masonry Walls. BRE. 1988).

9.2 Little can be done to remedy any problems which may arise in low density injected mineral fibre full fill cavity wall insulation.

10 *Kingspan Insulation Solutions*

10.1 There are a number of solutions to the problems identified in this 'White Paper' that can be employed using Kingspan Insulation Products.

10.2 In new build walls one of Kingspan Insulations products for partial fill cavity wall insulation can be used. The products are Kingspan **Kool**therm® *K8 Cavity Board,* Kingspan **Therma***wall* *TW51* and Kingspan **Therma***wall* *TW50.* Typical thermographic images of walls so insulated are shown below.

Image 12
The image shows a gable wall with a relatively even surface temperature. It is insulated with Kingspan partial fill insulation. There are well insulated lintels with no debris. Very little thermal bridging at this position can be identified, There is also very little air leakage at the verge. It should be noted that the rooms behind are well heated which further displays the well insulated nature of the construction.

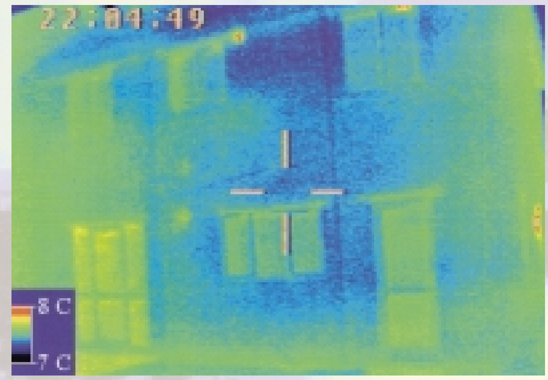


Image 13
This image displays the uniform thermal patterns which are associated with a well performing wall insulation system. It is insulated with Kingspan partial fill insulation. Some localised surface cooling is noticed due to wind effects.

10.3 In new build walls or refurbishment of existing walls Kingspan Insulation's product for insulated dry lining, Kingspan **Therma***wall* *TW52,* can be used.

10.3 For the refurbishment of existing walls one of Kingspan Insulation's products for external wall insulation, Kingspan **Kool**therm® *K5 EWB,* or Kingspan **Therma***wall* *TW53,* can be used.

10.5 Kingspan Insulation have also carried out a second thermographic survey for local authority B on a different housing estate on which there was a mix of properties, some insulated with injected mineral fibre full fill cavity wall insulation and some with external wall insulation using Kingspan Insulation products. Typical thermographic images from this survey are shown below.

Image 14
The externally insulated semi detached block to the right shows an even temperature distribution across the wall surface. This is in contrast to the semi detached block to the left, insulated with injected mineral fibre full fill cavity wall insulation which displays a distinctly higher surface temperature and irregular thermal patterns which are likely to be related to insulation defects.

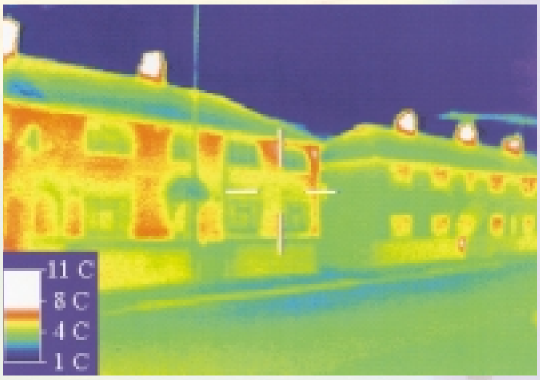


Image 15
This image contrasts the terrace insulated with injected mineral fibre full fill cavity wall insulation on the left with the externally insulated terrace on the right. The latter shows a uniform level of thermal performance while the former displays higher surface temperatures and irregular thermal patterns associated with possible insulation defects.

10.6 Whilst the properties on local authority B's second estate that were insulated with injected mineral fibre full fill cavity wall insulation displayed the same thermal patterns as the two other surveys, the properties insulated with external wall insulation exhibited uniform and lower external temperatures indicating a system performing as specified, unlike the properties insulated with mineral fibre.

Appendix A – Energy, CO_2 and Financial Calculations

Fuel Source	CO_2 eq.	Cost	Mix		Contribution to 1 kWh Total		
					Energy	CO_2 eq.	Cost
	g/kWh	£/kWh	MJ	kWh	kWh	g/kWh	£/kWh
Solid Fuels	389.1	0.0176	76.0	21.11	0.06	24.62	0.00
Natural Gas	227.2	0.0185	953.7	264.92	0.79	180.43	0.01
Electricity	896.9	0.0769	79.3	22.03	0.07	59.23	0.01
Oil	290.3	0.0177	91.9	25.53	0.08	22.22	0.00
Total				333.58	1.00	286.50	0.022238

Insulation Surface Area	a	m^2	42
Heating Efficiency	yr	%	0.8
Degree-Days Base		deg C	18
Degree-Day	DD	days K/yr	3190
Degree-Hour	DH = DD * 24	hrs K/yr	76560

VOIDS			INS.	UNINS.	AVER.	DIFF.	% INCR.
% of Area Covered		%	85	15			
U-value	U	W/m²K	0.44	1.39			
Energy Lost per Year	Q = (U*a*H)/1000r	kWh/yr	1769	5587	2341	573	32
CO_2 Equivalent Emissions of Lost Energy		kg	507	1601	671	164	32
Cost of Energy Lost per Year		£	39	124	52	13	32

LOW DENSITY			INS.	UNINS.	AVER.	DIFF.	% INCR.
% of Area Covered		%	85	15			
U-value	U	W/m²K	0.44	1.39			
Energy Lost per Year	Q = (U*a*H)/1000r	kWh/yr	1769	5587	2341	573	32
CO_2 Equivalent Emissions of Lost Energy		kg	507	1601	671	164	32
Cost of Energy Lost per Year		£	39	124	52	13	32

GAPS			INS.	UNINS.	AVER.	DIFF.	% INCR.
% of Area Covered		%	85	15			
U-value	U	W/m²K	0.44	0.53			
Energy Lost per Year	Q = (U*a*H)/1000r	kWh/yr	1769	2130	1823	54	3
CO_2 Equivalent Emissions of Lost Energy		kg	507	610	522	16	3
Cost of Energy Lost per Year		£	39	47	41	1	3

TOTAL			INS.			DIFF.	% INCR.
Energy Lost per Year	Q = (U*a*H)/1000r	kWh/yr	1769			1200	68
CO_2 Equivalent Emissions of Lost Energy		kg	507			344	68
Cost of Energy Lost per Year		£	39			27	68

Technical Advice

Kingspan Insulation Limited support all of their products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a free computer-aided service designed to give fast, accurate technical advice. Simply phone our TECHLINE with your project specification and we can run calculations to provide U-values, condensation/dew point risk, required insulation thicknesses etc… Thereafter we can run any number of permutations to help you achieve your desired targets.

We can also give general application advice and advice on design detailing and fixing etc… Site surveys are also undertaken as appropriate.

Please contact our Technical Services Department on the TECHLINE numbers below:

TECHLINE

UK	– **Free***fone* 0800 **610061**	
	– Fax:	**01544 388888**
	– e-mail:	technical.services @kil.kingspan.co.uk
Ireland	– Telephone:	**042 9795000**
	– Fax:	**042 9746129**
	– e-mail:	technical.services @kil.kingspan.ie

Customer Service

For quotations, order placement and details of despatches please contact our Customer Services Department on the numbers below:

UK	– Telephone:	**01544 388601**
	– Fax:	**01544 388888**
	– e-mail:	customer.service @kil.kingspan.co.uk
Ireland	– Telephone:	**042 9795000**
	– Fax:	**042 9746129**
	– e-mail:	customer.service @kil.kingspan.ie

NB

Kingspan Insulation reserve the right to amend product specifications without prior notice. The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to the uses described. For other applications or conditions of use, Kingspan Insulation offers a free Technical Advisory Service (see left) whose advice should be sought for all uses of Kingspan Insulation products that are not specifically described herein. When specifying the products that are described herein please check that your copy of this literature is current by calling our Technical Services Department (see left).

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